



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 09/590,621 | 06/08/2000 | Salman Akram | 3936US (99-0066) | 1302 |

7590 12/31/2002

Brick G Power
Trask Britt & Rossa
P O Box 2550
Salt Lake City, UT 84110

EXAMINER

BEREZNY, NEMA O

| ART UNIT | PAPER NUMBER |
|----------|--------------|
|----------|--------------|

2813

DATE MAILED: 12/31/2002

18

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/590,621

Applicant(s)

AKRAM ET AL

Examiner

Nema O Berezny

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 October 2002.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 and 36-49 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-23 and 36-49 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 08 June 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 16.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Claims 1-5, 10, 14-17, 36, 38, and 40 are rejected under 35 U.S.C. 102(e) as being anticipated by Ghaem et al. (6,046,910). Ghaem discloses a method of forming a flip chip semiconductor die, comprising: forming a plurality of stabilizers (Figs. 1, 2 and 4) comprising a dielectric material and adhering to the active surface of said die, said stabilizers being configured to at least partially stabilize an orientation of said die when disposed face down over a substrate, and positioned between a periphery of said die surface and conductive structures (Fig. 1); and wherein said stabilizer is adjacent at least one corner of said active surface, and adjacent opposite peripheral edges of said active surface (col. 6 lines 6-35; col. 8 lines 31-36). Ghaem also discloses said

Art Unit: 2813

stabilizers having a height that defines a substantially consistent die-to-substrate distance, and positioned so as to avoid contact with conductive traces on said substrate (Fig.1). Ghaem also discloses disposing at least one solder bump (el.32) on at least one bond pad (el.26) of said die, and disposing at least one conductive pillar (col.9 lines 19-24) on said at least one bond pad. Ghaem also discloses inverting and positioning said die onto said substrate to contact and bond conductive structures to corresponding contacts on said substrate (Figs.3-6); wherein said stabilizer is spaced from the surface of said die to said substrate, which is a greater distance than a minimum distance that said conductive structures protrude from said surface (Fig.1).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 9 and 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ghaem as applied to claims 1-5 above. Ghaem does not disclose providing a semiconductor wafer with a plurality of flip chip dice, or applying an insulative or photoresist layer onto said active surface and patterning said layer. It is well known in the semiconductor industry to use wafer fabrication and patterning an insulative or photoresist layer for the purpose of cost and time savings through mass fabrication, and mass patterning of said layer, respectively.

Claims 6-7, 18-19, 23, 41-45, and 47-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ghaem as applied to claims 1-5, 9-10, and 14-17 above, and further in view of Juskey et al. (5,264,061) and Hull (4,575,330). Ghaem does not disclose stereolithographically forming mutually adhered layers of photopolymer stabilizers to said die surface. However, Juskey discloses recognizing a location and orientation of a substrate or other object to receive layers of material (col.3 lines 8-35) and sequentially, stereolithographically forming a plurality of superimposed, contiguous, mutually adhered layers of photopolymer (col.4 lines 16-22, 29-34); Hull discloses stereolithographically adding a part to an existing structure, wherein said part is different in shape from said existing structure (col.10 lines 44-59). Hull also discloses securing said substrate or object to a carrier in a horizontal plane prior to processing (col.8 lines 14-16). Therefore, it would have been obvious to a person skilled in the art at the time of the invention to use the stereolithographic formation of Juskey and Hull with the method of forming a flip chip die of Ghaem. Stereolithography allows plastic parts to be used in many places where metal or other material parts are now used (Hull – col.3 lines 60-63).

Claims 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ghaem in view of Juskey and Hull as applied to claims 18-19 above, and further in view of Migdal (5,870,220). Juskey and Hull do not disclose using machine vision in conjunction with storing physical parameter data. However, Migdal discloses a machine

Art Unit: 2813

vision system to recognize the location and orientation of said substrate or object and storing physical parameters of said object in conjunction with a stereolithographic process (col.4 lines 3-17), wherein it is implied that the physical parameters of more than one die component is stored in computer memory with wafer fabrication.

Therefore, it would have been obvious to a person skilled in the art at the time of the invention to use the machine vision system of Migdal with the method of forming a flip chip die of Ghaem, Juskey and Hull in order to rapidly scan the object to be processed (Migdal - col.4 lines 3-4).

Claims 8, 13, and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ghaem in view of Juskey and Hull as applied to claims 1, 18-19, and 41 above, and further in view of Kuniaki (JP10189653). Ghaem et al. do not disclose introducing encapsulating between said flip chip die and said substrate. However, Kuniaki discloses introducing encapsulating material between a flip chip die and a substrate, wherein said encapsulant is securable to a stabilizer (Fig.2). Therefore, it would have been obvious to a person skilled in the art at the time of the invention to use the encapsulating of Kuniaki with the method of forming a flip chip die of Ghaem, Juskey and Hull in order to protect said device from environmental, chemical, and mechanical stress and contaminants.

Claims 37 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ghaem as applied to claim 36 above, and further in view of Lin et al. (3,871,015).

Art Unit: 2813

Ghaem does not disclose forming a stabilizer whose height is less than a minimum distance that said conductive structures protrude from said die surface, or employing a stabilizer structure to lengthen said conductive structures. Lin discloses a stabilizing structure whose height is less than a minimum distance of said conductive structures (col.5 lines 61-65), and a stabilizer which lengthens said conductive structures (col.3 lines 56-62). Therefore, it would have been obvious to a person skilled in the art at the time of the invention to use a stabilizing structure similar to that of Lin with the method of forming a flip chip die of Ghaem in order to control and manipulate the precise size and length of conductive structures in a flip chip device.

Response to Arguments

Applicant's arguments filed 10-8-02 have been fully considered but they are not persuasive.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., (1) the stabilizer has a plurality of superimposed, contiguous, mutually adhered layers of photopolymer, regarding claim 36; (2) the polymeric preforms support the integrated circuit component, regarding claims 1, 36; (3) stereolithographically formed stabilizers reduce the risk of short circuiting, regarding claims 18, 19, and 41) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Applicant contends that the polymeric preforms of Ghaem are not for the purpose of stabilizing and thus are not stabilizers as that term is utilized in the instant application. Examiner disagrees. Claims 1 and 36 state that "said at least one stabilizer being configured to at least partially stabilize an orientation of said at least one flip chip semiconductor die." There is no requirement for structural or mechanical support. The stabilizers of Ghaem at the corners of the die would certainly orient the die to the substrate.

Applicant contends that Ghaem does not disclose stabilizers that have a substantially consistent die to substrate height. Examiner disagrees. As shown in Fig.6 and stated in the rejection, the disclosed preforms are of equal size and show a consistent die to substrate distance.

Applicant contends that the elements of claims 9, 11, and 12 are not disclosed by Ghaem. Examiner agrees as stated in the rejection, and that was the reason for the taking of Official Notice for said claims. As a courtesy to Applicant, Examiner is providing the reference of Vindasius et al. (6,271,598) which discloses both wafer fabrication (Abstract – lines 14-23) and photoresist patterning (col.8 lines 54-64) for flip chip devices.

Applicant contends that there is no disclosure in the Hull reference for fabricating features on a semiconductor die. Examiner disagrees. Hull discloses in col.4 line 43 – col.5 line 3 how his invention of stereolithographically forming objects can be applied to microelectronics and electronic printed circuit design. Therefore, the disclosure of Hull is relevant and properly combined with Ghaem and Juskey.

Art Unit: 2813

Applicant contends that there is no teaching or suggestion for the three-dimensional printed circuit assembly of Juskey being useful for fabricating features on semiconductor dice, because Juskey is limited to fabrication of circuit boards. Examiner disagrees. As stated in the rejection for claims 6-7, 18-19, 23, 41-45, and 47-49, Juskey discloses recognizing a location and orientation of an object for stereolithographically forming sequential layers of a polymer upon said object (col.3 lines 8-35). Therefore, said recognizing of Juskey would be ideally suited for forming specific 3-dimensional objects upon another object such as a semiconductor chip.

Applicant contends that the polymeric preforms 40 of Ghaem are formed of a compressible material so that the polymeric bodies 50 can shrink and urge the conductive members into contact with the terminals (see col.7 lines 15-19). However, said cited text is referring to the material of the polymeric bodies 50, and not the polymeric preforms 40. Applicant also contends that a "rigid" stereolithographically formed preform 40 would interfere with the type of electrical contact used by Ghaem, and therefore goes against the purpose of Ghaem's disclosure. However, a "rigid" stereolithographically formed object is not disclosed by either Hull or Juskey. In addition, most polymeric bodies will inherently have some flexibility and would not be considered a rigid object such as ceramic or metallic objects.

Applicant contends that Migdal does not teach use of a machine vision system in conjunction with a stereolithography system to identify the location of an object such as a die where stabilizers are to be formed. Examiner disagrees. In col.4 lines 3-17, Migdal discloses the same stereolithographic abilities of recording the shape of the

Art Unit: 2813

object to be formed, reconstructing the 3D shape of the object through a computer, and stereolithographically forming the object as compared to that of Hull in col.2 lines 24-36. Even though Migdal alone does not specifically disclose forming a stabilizer on a die, Migdal in combination with Ghaem, Juskey, and Hull disclose all of the features of said claims 20-22. Applicant also states that Migdal only references stereolithography once in the entire patent. Mentioning something once is still disclosure.

Applicant contends that Ghaem discloses a microelectronic assembly which eliminates the need for underfilling encapsulant, and therefore would not have been motivated to combine said assembly with the encapsulant underfilling of Kuniaki. Examiner disagrees. Ghaem states in col.2 lines 44-48 that underfilling is not necessary "to reinforce rigid solder joints between a flip chip and a circuit board." However, both the solder preforms 40 and polymeric bodies 50 exist only at the assembly corners (Figs.2,8), leaving all four sides in between exposed. Therefore, underfilling the assembly according to Kuniaki would still "protect the device from environmental and chemical contaminants" as stated in the rejection, and would also protect the assembly from moisture.

Applicant contends that Ghaem does not disclose forming at least one stabilizer ... adjacent at least one corner of said active surface. Examiner disagrees. If Ghaem forms the polymeric preform then attaches it to the device, said preform is still being formed to the active surface of said device, as claimed.

Applicant contends that there is no teaching or suggestion in Lin of a stabilizer structure for lengthening the conductive structures. Examiner disagrees. The rejection

Art Unit: 2813

states exactly this, and in the cited text of col.3 lines 56-62 and col.5 lines 61-65, Lin also discloses that the increased volume of solder increases standoff, increases the distance between the chip and substrate, and stretches out the interconnection joints. Applicant also contends that Ghaem would not be motivated to use the interconnection joints of Lin since the structure of Lin does not restrict the flow of material between a substrate and a component as taught by Ghaem, and Ghaem does not teach formation of interconnection joints having varying stress resistance as taught by Lin. Examiner disagrees. A flip chip device inherently requires consistent connector height so that all of the connections make sound electrical contact with the substrate bond pads. A stabilizer that lengthens the conductive structures would accomplish this purpose by forming connectors of all the same height, and therefore creating a consistent die to substrate distance.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

Art Unit: 2813


the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nema O Berezny whose telephone number is (703) 305-3445. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on (703) 308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

NB
December 29, 2002


CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800